SECTION IV.—RIVERS AND FLOODS.

THE RIVERS DURING FEBRUARY.

By ALFRED J. HENRY, Professor of Meteorology.

The weather during February was not favorable to the production of floods. Northern streams were icebound and there were no excessively heavy rainfalls to swell southern streams, except as noted below. Warm weather caused the melting of some snow in the Ohio Valley watershed on the 18th and 19th, resulting in freshet stages in the Evansville (Ind.) district only. The highest stage at Evansville was 33.7 feet on the 25th. (Flood stage 35 feet.)

A rainy period in California from the 18th to the 21st caused the upper Sacramento to pass above the flood stage at Red Bluff on the 21st, Jacinto on the 22d, and Colusa on the 23d. On the lower San Joaquin flood stage was passed at Lathrop on the 23d and on the Mokelumne at Bensons Ferry on the 22d.

Heavy rains over North Carolina on the 20th caused the Roanoke River to pass the flood stage at Weldon, N. C., on the 22d, the Neuse to pass the flood stage at Smithfield on the 22d, and the Cape Fear River to pass the flood stage at Fayetteville on the same day. These rises were of short duration and caused comparatively little damage.

At the close of the month the tributaries of the Mississippi were at moderate stages and well able to carry off any sudden inflow of rain or melting snow.

The flood damage during February is shown below:

Money loss by flood.

Sacramento (Cal.) district:	
Tangible property, buildings, highways, levees, etc.....	$61,000
Farms and farm property, including prospective crops...	15,000
Stock and movable property.....	10,000
Total.....	86,000

SNOWFALL IN HIGH ALTITUDES, FEBRUARY, 1914.

California.—The snowfall during the month was slightly below the average and was confined to the higher levels. From 5,000 feet up in the Siskiyou and northern Sierra and above 6,000 feet in the southern Sierra and Sierra Madre there is a large amount of well-packed snow on the ground, with a high water content. Nearly every storm of the winter has been followed by rain extending often to 7,000 and 8,000 feet, and later by clear, cold weather, giving the snow fields a coating of ice which, under ordinary conditions, will prevent melting until late in the spring or summer. Present conditions indicate abundance of water for power purposes and irrigation during the coming season.

Snow density in California.—A few measurements of the density of snow at different parts of the State were made by weighing a cubic foot of snow. The water content of the snow was found to vary from 26 per cent to 59 per cent, the latter value, however, was found at the bottom of a 15-foot layer of snow at Summit, Cal., where a cubic foot taken from the surface weighed 21½ pounds, corresponding to a water equivalent of 34 per cent; a cubic foot taken at a depth of 64 inches weighed 28 pounds, corresponding to a water equivalent of 45 per cent, and finally a cubic foot taken at a depth of 174 inches or practically the bottom of the layer, weighed 36¾ pounds, corresponding to a water content of 59 per cent as above.—*G. H. Willson, Local Forecaster.*

Oregon.—Some snow fell in the Cascade and Siskiyou Mountains, and amounts ranging from 1 inch to over 4 feet were recorded at scattered stations in the Blue Mountains; elsewhere in the section little or no snow was reported.

At the end of February, compared with last year, there was less snow below the 4,000-foot level in practically all of the mountain ranges, while some stations above that elevation reported more.

Compared with the normal there was more snow than usual in the higher altitudes, but below 4,000 feet elevation there was generally less than the average amount on the ground at the end of this month.

The snow now appears to be well packed, in some instances having the consistency of ice.—*E. A. Beals, District Forecaster.*

Utah.—There was much less precipitation during February than in the preceding month and less than the normal amount. The month was mild and during the warm spells some of the snow in the valleys melted, uncovering the range land, and also caused further settling and packing of the greater depths in the mountains. However, in spite of the deficient snows during February, and the loss by melting, the reports are unanimous for an abundant water supply during the coming growing season.

In the Great Salt Lake Watershed the amounts in the hills and mountains ranged from 12 to 108 inches. In the Sevier Lake Watershed very little snow fell in the valleys, but some snow was added to the already considerable depths in the mountains, where it was well packed, the amounts ranging from 10 to 75 inches. The depth in the Green and Colorado Rivers Watershed ranged from 6 to 72 inches, the snow was well drifted and packed in nearly every locality.—*A. H. Thiessen, Section Director.*

Montana.—The snowfall for February was somewhat greater in the mountain districts of Montana than for either December or January preceding. It was, however, somewhat below normal in the mountain ranges east of the Continental Divide, but was normal or above over most of the Columbia drainage.

Considering only the amount of moisture stored in the mountains as snow, the outlook for a late water flow in the streams is less favorable than for several years.—*R. F. Young, Section Director.*

Wyoming.—An average snowfall of 9.2 inches for the State during the month of February was 0.7 inch below normal. In portions of the State, where the normal fall

was exceeded, in the lower elevations of the northeast accumulations of snow are of little value for purposes of irrigation; besides, moderate temperatures caused much of the snowfall in that section to disappear. At the higher elevations conditions were less favorable generally than at the close of the preceding month. On the Medicine Bow Range, watershed of the North Platte, and at Bechler River station, headwaters of the Snake River, conditions have improved. On the mountains adjacent to the latter point depths of 10 feet are reported. Depths of 6 feet are reported in the southwestern portion of Albany County. Accumulated depths on the watersheds of the North Platte, Green, and Snake Rivers promise sufficient water for the coming season; conditions on the Yellowstone Watershed are less promising, while on the watersheds of the Big Horn, Cheyenne, Powder, and Tongue Rivers decidedly unfavorable conditions prevail.—*R. Q. Grant, Section Director.*

Colorado.—Weather conditions during February were not favorable to material additions to the snowfall in the mountains. There was a general deficiency throughout the State, the fall being especially deficient in the southwestern and central portions. Depths on the different watersheds at the end of February were practically the same as at the end of January, except that the water content was higher. The latter ranged from 21 to 33 per cent when exposed to the sun and somewhat less in shaded localities. Good early and late flows are indicated.—*F. H. Brandenburg, District Forecaster.*

Idaho.—The snowfall during February was lighter than usual over most of the State, and the accumulated depth in the mountains was somewhat less than at the end of January. Mild temperatures at the close of the month caused the snow at the lesser elevations to disappear rapidly, but at the greater altitudes snow was settling rather than running off. The water content is rather high, probably about 30 per cent; conditions are favorable for early melting.—*E. L. Wells, Section Director.*

Nevada.—The snowfall for February was considerably less than normal in the Humboldt and normal or above in the Carson and Walker basins.

No snow of consequence remained on the ground below the 5,000-foot level at the end of February, and but little on south and west slopes up to the 7,000-foot level. On the east and north slopes, at an elevation of 6,000 feet, there were about 75 inches of very compact snow; at 7,000 feet, from 70 inches to 184 inches; at 8,000 feet, from 110 inches to 186 inches; at 9,000 feet or more, from 96 inches to 192 inches or more of very dry snow.

There has been no run-off of consequence above 6,000 feet, leaving practically all the precipitation since September 1 on or in the ground. This has exceeded the four-year average over the entire State, and near the Sierras it was nearly twice that amount.—*H. S. Cole, Section Director.*

South Dakota.—The average snowfall during February, 1914, in the greater portion of the Black Hills district of the State was 8.3 inches. The average amount remaining on the ground on the 28th was 2.2 inches. The water from melted snow has not increased the amount present in the streams in the Black Hills district.—*S. W. Glenn, Section Director.*

Arizona.—At the end of February, 1914, the higher levels of the White Mountains and the northern portion of the Blue range were covered to a depth of about 4 feet. There is little snow on the south slopes below the 9,000-foot line, while at that height on the north sides 6 to 21 inches remain. On the Santa Teresa, Graham, and Chiricahua Mountains the snow ranges from a trace at the 8,500-foot level on the north slopes to 3 or 4 feet on the peaks.

The Mogollon Mesa is well covered with snow, but it is not deep for the season. The higher slopes of the San Francisco Mountains hold from 6 to 10 feet, and on the Colorado and Kaibat Plateaus 2 to 4 feet of snow remain at elevations above 8,000 feet.—*Robert W. Briggs, Section Director.*

Washington.—On account of the general mildness of the month the snow did not accumulate in depth; at the end of the month it was less than on the 15th and was nearly everywhere less than the average.—*G. N. Salisbury, Section Director.*